DOCUMENT RESUME

ED 081 472 PS 006 703

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TITLE	Recognition Memory in Reflective and Impulsive Preschool Children.
INSTITUTION	Pittsburgh Univ., Pa. Learning Research and Development Center.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.
PUB DATE	73
NOTE	16p.; Preprint of article to appear in "Child Development"
AVAILABLE FROM	Learning Research and Development Center, Pittsburgh University, 160 North Craig Street, Pittsburgh, Pennsylvania 15260 ($0.50)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Cognitive Processes; *Conceptual Tempo; Individual Differences; Inner City; *Memory; Negroes; Perception; *Preschool Children; *Recognition; Visual Discrimination; Visual Learning; Visual Stimuli
IDENTIFIERS	Kansas Reflection Impulsivity Scale; Matching Familiar Figures Test

ABSTRACT

The reflection-impulsivity (R-I) dimension of individual variation incognitive processes is discussed. A literature review focuses on studies that have supported the validity of the R-I dimension as a concept, and studies providing evidence of a direct relationship between the R-I dimension and visual scanningstrategies. This study compares the performances of eight reflective and eight impulsive children (based on results of the Kansas Reflection-Impulsivity Scale) on a forced-choice recognition memory task. Subjects were black children attending an experimental inner-city preschool. The recognition memory task was divided into four experimental conditions of varying difficulty because of varying degrees of similarity between the correct and incorrect stimuli. It was hypothesized that the reflective children would perform significantly better in all four conditions. Results supported the hypothesis, and it was concluded that the tendency to perform detailed visual feature analysis is a major component of the cognitive-perceptual basis that underlies the R-I dimension. (DP)

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RECOGNITION MEMORY IN REFLECTIVE AND IMPULSIVE PRESCHOOL CHILDREN

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To appear in Child Development.

1973

PS 006703

The research reported herein was supported by the Learning Research and Development Center, supported in part by funds from the National Institute of Education (NIE), United States Department of Health, Education, and Welfare. The opinions expressed do not necessarily reflect the position or policy of NIE and no official endorsement should be inferred.

Abstract

Sixteen preschool children, eight reflectives and eight impulsives, were tested in a forced-choice recognition memory task. Experimental conditions systematically varied the possibility that correct responses could be made on the basis of verbal labels, purely visual feature analyses, or both. Reflective children made more correct recognition choices than did impulsive children under all experimental conditions. Order of condition difficulty indicated that both verbal labelling and visual feature analysis independent of verbal processes are responsible for successful recognition performance in these Ss.

RECOGNITION MEMORY IN REFLECTIVE AND IMPULSIVE PRESCHOOL CHILDREN[1]

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Kagan and Kogan's (1970) review of the literature on individual variation in cognitive processes indicates that the dimension of reflection-impulsivity is a reliable and useful dimension along which to conceptualize cognitive style. During an initial sequence of studies, Kagan and his collaborators (Kagan, Rosman, Day, Albert, & Phillips, 1964) developed the Matching Familiar Figures Test (MFF), a reliable means of evaluating a child's relative position on a dimension of conceptual tempo which Kagan et al. called reflection-impulsivity. In the MFF, S is shown a standard stimulus (a picture of a familiar object), and is then asked to choose one of six possible variants that exactly matches the standard. Latency to first response and number of errors on each of twelve such items are recorded: Ss above the median in mean latency and below the median in total number of errors for a particular age and sex subgroup are designated as reflectives; Ss below the median in mean latency and above the median in total errors are designated as impulsives. Since the initial research, a number of studies have shown consistent performance differences on a variety of measures: Reflective children

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[1]The authors wish to thank the teachers and staff of the Frick School for their helpful cooperation in this study.

make fewer reading errors (Kagan, 1965), fewer errors of commission on a serial learning task (Kagan, 1966), fewer errors on inductive reasoning tasks (Kagan, Pearson, & Welch, 1966), and tend to focus more on a hypothesis testing task (Nuessle, 1972).

In addition to the research extending the validity of the concept of R-I, several recent studies have experimentally investigated direct relationships between R-I and visual scanning strategies. Siegelman (1969) found that on a second administration of the MFF, impulsive fourth-graders scored two and one-half times as many variants per item as did reflectives, while reflectives distributed their attention more evenly across the standard and the variants. Drake (1970), using a Mackworth eye-marker camera, found that reflective third-graders made more standard-variant comparisons on the MFF than did impulsive third-graders. Odom, McIntyre, and Neale (1971) compared the perceptual learning of reflective and impulsive kindergarteners. The performance of the reflective Ss indicated that they perceived and evaluated information based on the feature differences of stimulus arrays; the information processed by the impulsive Ss could not be identified.

Although these authors suggest that same-aged reflective and impulsive children use different task strategies, and Drake and Odom et al. suggest that reflectives and impulsives perform different kinds of feature analyses of stimulus arrays, these suggestions remain speculations as to the cognitive-perceptual basis for these performance differences. Prior to further speculation, it is first necessary to demonstrate differences in the extent to which reflective and impulsive Ss can use feature differences on a task which requires visual feature analyses for successful performance. The purpose of this study was to demonstrate that reflective preschoolers would show a greater tendency to

perform detailed feature analyses of stimuli as measured by their superior performance on a forced-choice recognition memory task.

Method

Subjects

Twenty-four black children attending an experimental inner-city preschool in Pittsburgh participated in the research. The final sample consisted of seven boys (Mean CA = 5 years - 0 months, range = 4-8 to 5-3) and nine girls (Mean CA = 5 years - 1 month, range = 4-8 to 5-4), all of whom came from lower or lower middle-class socio-economic backgrounds.

Materials

The Kansas Reflection-Impulsivity Scale (KRISP) (Wright, 1971) was used to determine reflective-impulsivity classification because: (1) it had been developed specifically for use with children of preschool age, and (2) pilot testing indicated that even the simplest version of the Matching Familiar Figures Test (six-variant) was too difficult and frustrating for these children. The KRISP is based on the MFF, but the five easier warmup items and the ten test items require less difficult discriminations and consist of much grosser feature differences than the MFF items.

Stimuli for the recognition memory task consisted of a presentation deck and test deck. The presentation deck consisted of 80 3- x 5-inch laminated white cards, on each of which was a black line drawing of a common object or animal. The test deck consisted of 80 5- x 8-inch laminated cards, on each of which were two black line drawings.

Procedure

The 24 children, 12 boys and 12 girls, attending the preschool were individually administered the KRISP during a first session lasting approximately ten minutes. The essential instructions given to the child were that he was always to point to the variant (one of four or five on the lower page) that was just exactly like the standard (on the upper page). None of the children had any difficulty understanding the instructions once they had gone through the five practice items. For each of the ten test items, the experimenter recorded the number of errors the child made on each item (a maximum of three errors per item was permitted) and the response latency for each item (time from stimulus presentation to first response, whether correct or not). As suggested by Kagan et al. (1964), for each sex separately, children whose mean response latency was above the median and whose total number of errors was below the median were classified as reflective; children whose mean response latency was below the median and whose total number of errors was above the median were classified as impulsive. Using this procedure, a total of 11 children was classified as reflective (5 girls, 6 boys) and 10 were classified as impulsive (5 girls, 5 boys).

In a second session held a week later, these 21 children were individually administered the recognition memory task. Each child was seated at a table, handed the presentation deck of 80 cards, and given the following instructions: "I have a deck of cards with drawings on them of animals and things that you have seen before. I want you to look carefully at each of these cards and go through the deck. When you finish looking at each card, turn it over and put it in a pile over there." The E then simply recorded the total time it took the S to go through the presentation deck.

Upon completion of this initial task, the S was told: "Now I'm going to show you some more cards. Each one has two drawings on it. I'll show you each card and I want you to look at both drawings and point to the one you saw before in the first part of the game. If you are not sure which one it is, I want you to guess anyway." When it appeared that the child's attention was wandering, the essential instruction, "pick the one you saw before," was repeated. The S was then shown the deck of 80 test cards, one at a time.

Experimental Conditions

The recognition test deck consisted of 80 cards, 20 from each of four experimental conditions. Within each deck of 20, the correct figure was on the left position on ten of the cards and on the right on the other ten. All children saw the 80 test stimuli in the same completely randomized order.

1. Condition (S_1 - S_0): Twenty stimuli were randomly chosen from the 80 original stimuli (S_1) and each was paired with a completely new animal or object on the test card. (Examples of presentation and recognition test items for this and the following conditions are presented in Figure 1.) This condition should be the easiest, as it requires only a global feature analysis and the correct choice can also be made on the basis of the name of (S_1) stimulus.

2. Condition (S_1 - S_2): Twenty different stimuli from the original 80 (S_1) were each paired with another stimulus with the same name, drawn in the same style and differing from S_1 in only one minor feature (S_2) (see Figure 1b). This condition should be the most difficult, since choosing the correct stimulus requires a rather complete

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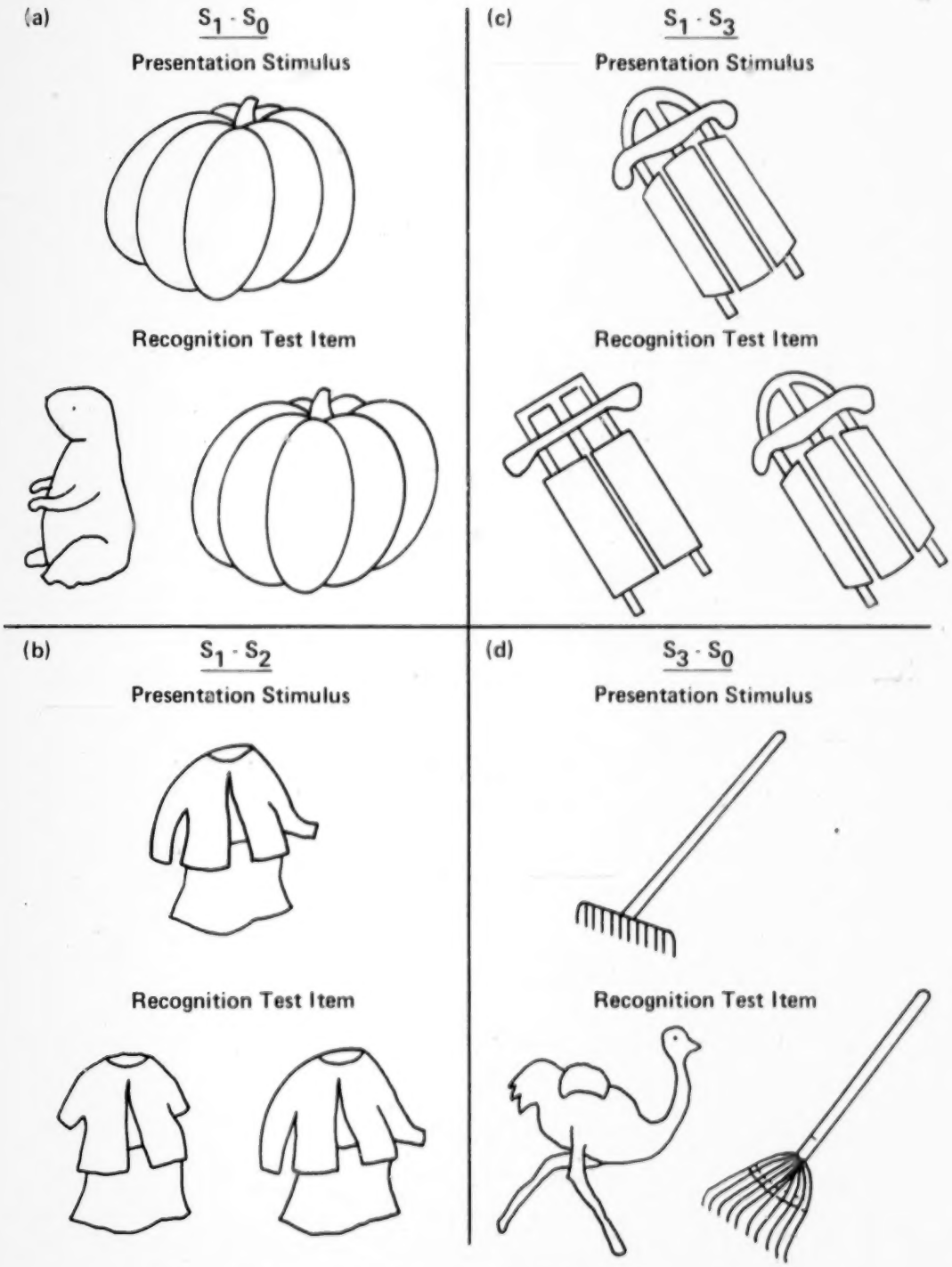

Figure 1. Examples of Presentation Stimuli and Recognition Test Items for Each of the Experimental Conditions.

feature analysis of the original (S_1) stimulus during initial presentation, and the correct choice cannot be made on the basis of the name of the stimulus.

3. Condition (S_1 - S_3): Twenty different stimuli from the original 80 (S_1) were paired with another stimulus with the same name, but drawn in a very different style and differing from S_1 in several different details (S_3) (see Figure 1c). This condition should be of intermediate difficulty, since it should be easier to discriminate the correct choice on the basis of more features than in (S_1 - S_2), but the correct choice still cannot be made on the basis of the name of the stimulus.

4. Condition (S_3 - S_0): The remaining 20 stimuli from the presentation deck were redrawn in a similar fashion as the S_3 stimuli in (S_1 - S_3) and were each paired with a completely new animal or object on the test card (see Figure 1d). Although the child has never seen S_3 before, condition (S_3 - S_0) should be of approximately the same level of difficulty as (S_1 - S_0), since correct choice requires only a global feature analysis, and correct choice can be made on the basis of the name of the stimulus. This condition was included to see how children's recognition memory functioned for stimuli that they had never seen before, but for which they might have either a global template or name from the presentation deck.

If reflective children tend to perform more detailed feature analyses of stimuli (and there is no a priori reason not to consider labelling the result of a feature analysis), then reflective children should show superior performance in all four experimental conditions.

Results

KRISP Data

The mean KRISP latency for the boys (4.23 seconds, S.D. = 1.71) was not significantly different from that of the girls (4.67, S.D. = 2.29; $t < 1$). Although boys made somewhat more errors on the KRISP (Mean = 6.83 errors, S.D. = 5.11) than did girls (Mean = 4.67, S.D. = 3.66), this difference was not significant ($t = 1.19$, $df = 22$, $p > .10$). KRISP latency and KRISP errors were significantly and negatively related ($r = -.53$, $df = 22$, $p < .01$); the magnitude of this correlation is of approximately the same magnitude as that found in the KRISP standardization data (Wright, 1971) and in much of the research done with the MFF (Kagan et al., 1964). This would seem to indicate that the KRISP is an adequate instrument to assess reflection-impulsivity in preschool children.

Five children (3 reflectives, 2 impulsives) showed such marked position bias on the test of recognition memory (on the last 40 cards these children chose either the left or the right figure on all 40 trials) that their data were excluded from further consideration. Thus, the final sample consisted of 16 children: 4 reflective boys, 4 reflective girls, 3 impulsive boys, and 5 impulsive girls. For these subjects, sorting time and KRISP latency were unrelated either to each other or to any of the recognition test measures ($r \leq .38$, $df = 14$, $p > .10$). KRISP errors, however, were significantly and negatively related to recognition test performance: Children who made fewer KRISP errors tended to make more correct responses on the 80 test items ($r = -.53$, $df = 14$, $p < .05$). Interestingly, this correlation seemed largely due to the significant relationship between KRISP errors and the number correct of

the 40 most difficult items (the ten most difficult in each condition) ($r = -.68$, $df = 14$, $p < .01$); the relationship between KRISP errors and the number correct of the 40 easiest items was not significant ($r = -.25$, $df = 14$, $p > .10$).

Recognition Memory

Since preliminary t tests on the recognition memory measures (sorting time, total correct/80, total correct/20 in each condition) indicated no significant differences between boys and girls (all t's < 1), data were collapsed over sex for the formal analyses. The mean sorting time (presentation deck) of the reflectives (279.0 seconds, S.D. = 112.9) was not significantly different from that of the impulsives (297.6, S.D. = 102.2; $t < 1$).

The number correct of the 20 test cards in each of the four conditions was tabulated for each S and these scores were subjected to a 2 (Reflective-Impulsive) X 8 (Ss) X 4 (Conditions) analysis of variance with repeated measures on the last factor. The means and standard deviations for each condition for reflective and impulsive children are presented in Table 1. The significant main effect of R-I ($F = 6.00$, $df = 1/14$, $p < .05$) indicated that reflective Ss made more correct responses on the test of recognition memory (71%) than did the impulsive Ss (63%). As predicted, there was a highly significant main effect of experimental conditions ($F = 5.83$, $df = 3/42$, $p < .005$). As can be seen from Table 1, mean performances in the experimental conditions were ordered: $S_1 - S_0$ (76% correct), $S_3 - S_0$ (70%), $S_1 - S_3$ (66%), $S_1 - S_2$ (56%). Scheffé (.05) confidence intervals (CV on raw means = 2.47) indicated that performance in ($S_1 - S_0$) and ($S_3 - S_0$) was significantly greater than that in ($S_1 - S_2$); no other comparisons were significant.

Table 1

Means and Standard Deviations of Number of Correct Recognition Responses for the Four Experimental Conditions

		All Conditions		Experimental Condition							
				$S_1 \cdot S_0$		$S_1 \cdot S_2$		$S_1 \cdot S_3$		$S_3 \cdot S_0$	
Group	N	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Reflectives	8	56.63	5.80	15.75	1.58	12.13	2.90	13.88	2.70	14.88	1.89
Impulsives	8	50.63	3.78	14.63	2.26	10.25	2.71	12.63	3.20	13.13	1.46
All Ss	16	53.63	5.66	15.19	1.97	11.19	2.88	13.25	2.93	14.00	1.86

The R-I X Condition interaction was not significant ($F < 1$), indicating that reflective Ss made more correct responses than impulsive Ss in all four experimental conditions.

To determine whether or not the reflective Ss showed superior performance across all items, the ten easiest and the ten most difficult items within each condition (determined on the basis of previous research with older children) were summed over the four conditions. Analysis of the easy items indicated that the performance of the reflectives (31.38/40 or 78% correct) was not significantly greater than that of the impulsives (29.25/40 or 73%) ($F = 1.69$, $df = 1/14$, $p > .10$). Analysis of the difficult items, on the other hand, indicated that the performance of the reflectives (25.25/40 or 63%) was significantly greater than that of the impulsives (21.25/40 or 53%) ($F = 9.24$, $df = 1/14$, $p < .01$). Whereas the performance of the reflective Ss on the difficult items was significantly greater than chance ($t = 2.58$, $df = 6$, $p < .025$, one-tailed), that of the impulsive Ss was not ($t < 1$).

Discussion

As predicted, reflective children performed better on the recognition memory task than did impulsive children; and this difference in performance was more or less constant across all four experimental conditions. While these results do not require a hypothesis that reflective children tend to perform a more thorough and detailed feature analysis of the stimulus array, such a hypothesis would account for the data. Whereas reflective and impulsive children did not differ on the easy items within each condition, reflectives recognized more

of the difficult items (which presumably required a more detailed feature analysis), thus ruling out any hypothesis of generally inconsistent performance by impulsive children.

The relative difficulty of the four experimental conditions was as predicted. Since performance was consistently highest in the two conditions where successful performance could be achieved by labelling the stimuli during original presentation ($S_1 - S_0$ and $S_3 - S_0$), it appears that verbal labelling (which undoubtedly facilitates feature analysis), as well as visual feature analysis independent of verbal processes (as in $S_1 - S_3$), is responsible for successful recognition performance in preschool children.

Since KRISP or MFF items cannot be correctly solved on the basis of verbal labels, the present data seem to indicate that the tendency to perform detailed visual feature analysis is a significant component of the cognitive-perceptual basis underlying the reflective-impulsive dimension.

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